# Appendix 1. Dialogue methods in the context of Integration and Implementation Sciences

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The aim of this book is to provide a specific methodological 'tool kit' for researchers who focus on real-world problems and who seek to bring together disciplinary and stakeholder insights into a particular problem. This tool kit focuses on dialogue methods for bringing together multiple perspectives to address real-world problems.

As we foreshadowed in the introduction, we see this as only one of the methodological skills that researchers oriented towards real-world problems require. We argue for a particular set of conceptual and methods skills, which we call Integration and Implementation Sciences (I2S). Here, we describe the core elements of this new crosscutting discipline. We have provided details about the rationale behind I2S elsewhere (Bammer 2005, 2008b), so this is presented only briefly here. We then outline the four cornerstones of I2S. We focus on one of those cornerstones—integrating disciplinary and practice (stakeholder) knowledge—where the dialogue methods for research integration are located, to put this tool kit into a broader context.

## Rationale for developing I2S

There is growing appreciation of the importance of interdisciplinary and trans-disciplinary research that focuses on real-world problems (referred to from now on as cross-disciplinary research), alongside research that advances understanding through a single discipline. There are three challenges in conducting such research that are not yet resolved:

1.  there are no well-established institutional structures within which to undertake real-world research
2.  there is no accepted way to deal with weaknesses in current approaches to cross-disciplinary problem-based research
3.  recurrent issues in tackling real-world problems that are not within the domain of any discipline or practice area.

I2S aims to provide a solution to all three challenges. In terms of institutional structures, I2S shifts the focus away from the content of real-world problems to the methods for addressing them. In other words, rather than trying to find agreed ways to institutionalise approaches to specific problems, such as multitudes of centres covering bio-security, climate change, obesity, tobacco

control, and so on, approaches to cross-disciplinary problem-based research are institutionalised through a discipline of Integration and Implementation Sciences, which will be accommodated as a standard academic department. I2S researchers then provide the linchpin for investigations into real-world problems, providing a concrete hub around which diverse discipline and practice perspectives can be drawn on in a flexible manner. The discipline and practice experts involved in investigating the real-world problem can change as the requirements of the investigation change.

In terms of how I2S will be organised, some useful analogies can be drawn with statistics. Like statistics, I2S is a crosscutting discipline that works on three levels: i) a core of people, the disciplinary specialists, who focus on the development of integration and implementation theory and methods; ii) a substantially larger group of people, the equivalent of applied statisticians, who focus on integration and implementation in relation to specific problem areas—for example, in bio-security, the environment, population health, and so on. They not only apply what is known to the problem area, they use their work on the problem to develop new integration and implementation theory and methods; and iii) just as most researchers have at least a basic appreciation of statistics, its uses and where to find advanced expertise when they need it, most researchers will also have a similar appreciation of Integration and Implementation Sciences.
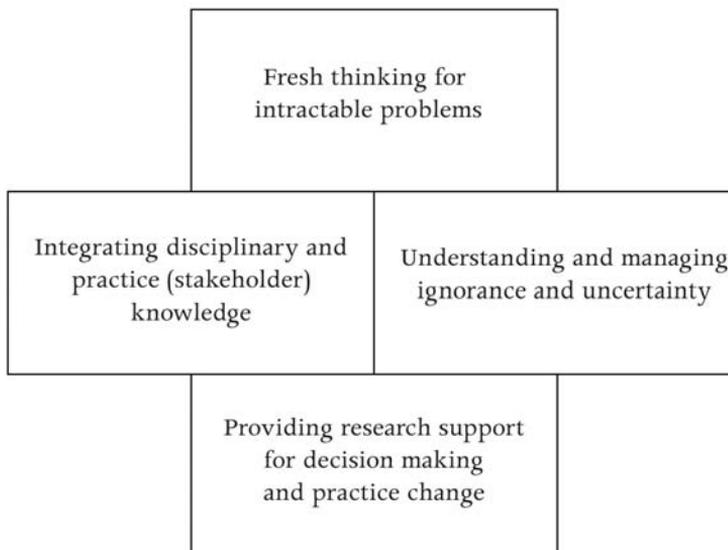
A disciplinary hub focusing on integration and implementation theory and methods also addresses two fundamental weaknesses that cross-disciplinary problem-based research suffers from as it is currently conducted. The first is that, unlike discipline-based research, there is no core methodological underpinning to cross-disciplinary problem-based research. As a consequence, the quality of any particular piece of such problem-based research is not guaranteed and is hard to assess. Furthermore, the outcomes are likely to be much more hit-or-miss than in discipline-based research. The second weakness is that while many cross-disciplinary problem-based teams develop new concepts and techniques, there is no recognised systematic way of communicating such insights between problem-based teams. In this book, we see this with dialogue-based methods for research integration, with the communication gap between disparate problem areas, so that, for example, researchers working on a problem of environmental management are unlikely to be aware of relevant innovations in public health or security. This has slowed progress in the development of cross-disciplinary problem-based research and has led to considerable 'reinvention of the wheel'. I2S aims to overcome this problem by providing cross-disciplinary problem-based researchers with a foundation of agreed core concepts and methods for undertaking their work, as well as an institutional mechanism for building the discipline and for communicating new developments.

The third area involves the domains that I2S should cover. We suggest that these should be areas relevant to research integration and implementation, which are not the territory of any established research discipline or practice area. The foundation of I2S is therefore twofold. On the one hand, it involves compiling concepts and methods developed in disciplines or practice areas that individually address only part of the problem. In addition, it involves bringing together ideas and techniques developed in addressing a particular problem, for which there is currently no communication mechanism, as outlined above. This book of dialogue-based integration methods is an example of the latter. A recent book bringing together a range of disciplinary and practice perspectives on uncertainty (Bammer and Smithson 2008) is an example of the former. In other words, I2S covers integration and implementation concepts and methods that none of the established disciplines or practice areas has the mandate to pull together.

## The four cornerstones of I2S

We suggest that there are four domains that I2S covers. Real-world problems require not only the integration of insights from diverse discipline and practice perspectives, as presented in this book, they need new thinking to determine ways forward, they require effective management of knowledge gaps and uncertainties, and they need effective uptake of research findings into policy and practice change.

We present this diagrammatically, as follows:



Fresh thinking for intractable problems

Integrating disciplinary and practice (stakeholder) knowledge

Understanding and managing ignorance and uncertainty

Providing research support for decision making and practice change

Many of the real-world problems that societies face are intractable, so that sparking innovative thinking about them is essential. For example, how do we balance the rights of individuals with the prevention of abuse of legal safeguards by criminals; how do we motivate young people to become engaged, productive citizens; how do we encourage independence in medical research but restrict the development of potentially dangerous viruses? I2S seeks to develop concepts and methods that can catalyse innovative ways forward in thinking about such problems, leading to more effective policy and practice approaches.

Integrating disciplinary and practice (stakeholder) knowledge has three elements: useful concepts, a range of effective methods and a standardised way of describing such integration. The dialogue-based methods we present in this book represent one class of methods. We describe this domain in more detail below.

Real-world problems also have many different types and aspects of ignorance and uncertainty embedded within them and there is currently no systematic way of recognising and dealing with all these attributes. Managing unknowns is just as important as making maximum use of what is known. This involves concentrated attention on the nature of ignorance and uncertainty, including the irreducibility of some uncertainties. It also involves understanding how people think about and respond to uncertainty—for example, through exploration of the metaphors they use, their motivations and even their moral orientations. Further, it involves examining different ways of coping and managing under uncertainty, especially in relation to meeting the adaptive challenges posed by uncertainty. The possibilities range from outright denial or banishment to acceptance and even exploitation of uncertainty. Each kind of response can be shown to have strengths and weaknesses that indicate when it is likely to be adaptive. While different disciplines and practice areas have established ways of dealing with ignorance and uncertainty—for example, statisticians focus on probability-based approaches, intelligence analysts focus on distortion, historians take taboo into account and psychologists think about norms—no discipline or practice area has the role of bringing all of these different approaches together (Bammer and Smithson 2008).

In terms of providing research support for decision making and practice change, we suggest treating decision making and practice change separately. For the former, in the past decade or so, there has been growing interest in the lack of impact much research has on policymaking and how this can be remedied. This is a subset of a larger problem—namely, how to increase consideration of research knowledge in decision making more generally, not only by policy-makers, but by business leaders, community activists, non-government organisations and professional groups. We suggest that this has five elements: a) understanding decision-making processes—for example, government policymaking or business

commercial decision making; b) appreciating the attributes of influential research; c) delineating different types of researcher–decision maker engagement—ranging from one-way communication to the co-production of knowledge—and their strengths and weaknesses; d) understanding how institutions can influence what research is taken up by decision makers; and e) developing more effective ways to evaluate research support for decision making.

Furthermore, improving decision making might not necessarily lead to change on the ground. Understandings about how change occurs are widely dispersed in areas such as the diffusion of innovation, advertising, agricultural extension, health promotion, social entrepreneurship, community organising, organisational change and counselling. Again, no discipline or practice area has the mandate to bring all these perspectives together so that more can be learnt from the synergies and points of difference. Consequently, this is a key task for I2S.

## Focusing on integrating disciplinary and practice (stakeholder) knowledge

As we outline above, integrating disciplinary and practice (stakeholder) knowledge has three elements: useful concepts, a range of effective methods and a standardised way of describing such integration. The dialogue-based methods we present in this book represent one class of methods.

The concept at the core of this domain is systems-based thinking. Systems thinking plays an important role in identifying interconnectedness. We need better approaches to understanding and managing connectedness to complement strong reductionist research methods. Reductionist research helps us understand single issues more deeply. It is key, for example, to identifying viruses or understanding group behaviour in panic situations. This needs to be balanced by systems thinking, which helps us deal with real-world problems such as responding to a terrorist attack or understanding the impact of a new epidemic.

Effective systems-based thinking plays out through ideas and, especially, methods to:

- improve scoping, problem framing and boundary setting, which define how a real-world problem will be approached and which perspectives will be included
- integrate effectively—for example, at the end of a multidisciplinary process or throughout a trans-disciplinary process
- identify and manage conflicts expediently between, for example, values, interests and epistemologies.

At present, each of these groups of methods is tackled on an ad hoc basis by cross-disciplinary problem-based researchers and, as indicated above, no

discipline or practice area can fully inform their considerations, or act as a repository for the insights generated in various problem-based projects.

Scoping, problem framing and boundary setting are interlinked and are essential for more comprehensive approaches to problems and for making the inherent limitations of all cross-disciplinary problem-based research evident. In particular, it is impossible to research everything, let alone everything at once, so that the focus of a problem has to be restricted. Scoping, problem framing and boundary setting attend to different aspects of this.

As Bammer (2006c:4) has described elsewhere: 'Scoping is the preparatory stage of a project where we systematically think about what we can best do with the time, money, and people we have at our disposal in order to use those resources most effectively'. In terms of problem framing, the way we see problems and the language we use to describe them can play a powerful role in setting the basis for research integration. For example, research on terrorism could be defined or framed as 'an examination of individual factors involved in producing terrorist acts' or alternatively as 'an examination of cultural and environmental issues that lead to the commission of terrorist acts'. Both are about understanding why people engage in terrorist activities, but one approach frames it as a problem of individuals, whereas the other treats it as a societal problem, especially examining culture and the social environment. The way a problem is framed already implicitly sets some boundaries around the problem. The boundaries specify what will be included, excluded and marginalised (Midgley 2000). An important aspect of this for research integration is determining which disciplines and which non-academic or practice perspectives will be included in the project.

Second, integrating more effectively involves the development of a range of methods. This book describes a significant class of methods—namely, those based on dialogue. We suggest that there are four other classes of methods: model based, product based, vision based and common metric based (Bammer 2006d).

While modelling is not necessarily integrative, the process of building a model can be an effective way of bringing together different discipline and practice insights. For example, the Australian Cooperative Research Centre (CRC) for Greenhouse Accounting developed a modelling shell to encompass insights from soil science, plant biology and ecosystem dynamics. There is a wide array of modelling methods, ranging from conceptual mapping (Trochim and Trochim 2007) and formal system dynamics models (Maani and Cavana 2007) to agent-based models (Srbljinovic and Skunca 2003) and purpose-built models such as those used in the CRC for Greenhouse Accounting example. The utility of the final model can be a measure of how well the integration has been conducted.

Because modelling methods are used so widely, we class them in their own right, but they can also be seen as a special case of product-based methods. Like building a model, developing a product can be effective for synthesising discipline and practice knowledge. Probably the best-known example is the building of the atomic bomb. The atomic bomb project brought together the knowledge of physical scientists, engineers, industrialists, the military and politicians to synthesise basic science (such as achievement of controlled fission), the solution of a vast range of technical problems (such as developing an implosion trigger device), engineering and manufacturing prowess (as in generating adequate amounts of fissionable material) with military and political know-how (in the testing and deployment of the bombs) (Rhodes 1986).

The next class of methods—vision-based integration—involves having an ideal to work towards. The ideal is generally not tangible, like a product, but is a motivating force, which can lead to the development of a set of principles or some other unifying outcome. An example is the work of the World Commission on Dams, which has been guided by the idea of 'development effectiveness'—in other words, equitable and sustainable human development (World Commission on Dams 2000:xxxiii). The commission aimed to achieve a balance between demands for irrigation, electricity, flood control and water supply (the benefits of dams) and debt burden, displacement, the impoverishment of people and disturbance of ecosystems and fishery resources (the costs of dams). Consequently, in its research and consultation activities, the Commission worked with those displaced or otherwise affected by dams, as well as with powerful funders and construction industries—specifically, 'government agencies, project affected people and non-governmental organisations, people's movements, the dam construction industry, the export credit agencies and private investors, and the international development community' (World Commission on Dams 2000:viii). In particular, this involved synthesis of a range of technical, social, environmental, financial and economic evidence from case studies, country studies, a survey, technical reports, submissions and forums (see also Bammer 2006a).

Finally, common metrics-based methods involve converting various discipline and practice-based inputs into a single measure, such as a dollar value, global hectares of land, metric tonnes of carbon dioxide equivalent or disability-adjusted life years. Applying common metrics in research integration essentially has four steps: i) determining which common metric is most relevant to the research question in hand; ii) seeking disciplinary and stakeholder input to determine the parameters of the research problem that should be included in the common metric conversion and analysis; iii) where necessary, applying disciplinary and stakeholder knowledge to convert factors into the common metric value (for example, converting land use into a dollar value); and iv) combining the assigned values through simple arithmetic or some other manipulation (often modelling).

In terms of the third major group of methods—identifying and managing conflicts between, for example, values, interests and epistemologies—bringing a range of people with different perspectives together inevitably means that that there will be differences, and sometimes clashes, between them. The key integrative task is to maximise the insights from the different perspectives and to minimise unproductive conflicts and other such effects (Bammer 2008a). For example, principled negotiation, which focuses on differences in interests, is an effective tool for much dispute resolution. It concentrates on creative problem solving and fair accommodation of diverse interests (Bammer 2006b; Fisher et al. 1991; Gray 1989; Ury 1993). Identifying ways of dealing with other problematic differences is a fertile area for further research.

Finally, we suggest that a key problem with research integration is that there is no agreed standard way for describing or analysing it. This can lead to key elements being ignored, along with muddled thinking. Throughout this book, we use a simple framework based on six questions (Bammer & Land & Water Australia Integration Symposium Participants 2005).

1.  What is the integration aiming to achieve and who is intended to benefit? This question aids thinking more clearly about the integrative purposes and differentiating them from other research aims, such as the development of new discipline-based knowledge.
2.  What is being integrated? This helps considerations of the expertise that needs to be marshalled to achieve the integration aims. It also encourages clarity around the boundaries of the research, as discussed above.
3.  Who is doing the integration? This question highlights that integration does not necessarily involve a group process. While the integrative process can be designed to involve everyone in the project, the task can be delegated to a subgroup or even one person. We suggest that an I2S specialist should be a key player.
4.  How is the integration being undertaken? This question focuses attention on integrative methods. We suggest that there are five classes of integration methods, which we have outlined above.
5.  What is the context for the integration? The question directs attention to the political or other action circumstances that have led to the research and which could be influential during its life. It also focuses on the institutions that are involved in funding or managing research integration. Integrated research is often undertaken in response to a driver from outside the research community, such as public concern, government policy or business innovation. Understanding the context can therefore be critical for appreciating how the research is shaped and the outcomes assessed.
6.  What is the outcome of the integration? This involves examining what the integration produced, as well as the process of integration.

We use the framework throughout this book as a model for how such a systematic description could be structured. As we show in our examples, the elements can be presented in any order and can be combined when occasion demands.

## Conclusion

In this appendix, we have briefly described a particular set of conceptual and method skills, which we call Integration and Implementation Sciences (I2S). We suggest that effectively tackling real-world problems requires a new type of researcher, who can draw together discipline and practice experts, and that such researchers need a solid foundation in the skills we outline here.

We propose that I2S can provide: a) the hub around which research institutions can organise teams to investigate real-world problems; b) a baseline level of quality for such work; c) a way of transmitting new ideas and methods between groups focusing on different real-world problems; and d) a home for drawing together and further developing recurrent issues in tackling real-world problems that are not within the domain of any discipline or practice area.

In terms of the last point, we suggest that I2S covers four domains—namely, concepts and methods to enhance:

- fresh thinking on intractable problems
- integration of disciplinary and stakeholder knowledge
- understanding and management of ignorance and uncertainty
- the provision of research support for decision making and practice change.

The dialogue methods we present here have been compiled as part of fleshing out the domain of the 'integration of disciplinary and stakeholder knowledge'. We have identified, along with dialogue-based methods, four other major groups of methods: model based, product based, vision based and common metric based. As well as these integration methods, the domain also includes concepts and methods to scope, frame and set boundaries around the real-world problem being investigated, as well as to identify and resolve inevitable conflicts around epistemologies, interests, values and so on. Systems-based thinking provides the core conceptual underpinning to this domain. Finally, we argue for an agreed standard way of describing and analysing research integration and provide a simple six-question framework, which we have found to be an effective starting point.